



Dam engineering tasks and challenges discussed in Freising

More than 500 participants gathered for the 14th German Dam Symposium and 7th ICOLD European Club Meeting in the Bavarian town of Freising, Germany, from 17 to 19 September. Hosted by the German National Committee on Large Dams, the Symposium focused on the theme: 'Dams in Europe - Tasks and Challenges'. Delegates from several European countries and as far afield as Iran, Australia, and Nigeria were represented at the event.

Recent growth and development in the dam industry was one of the main reasons for bringing together a dam meeting in Bavaria, especially in light of recent works on the Bavarian flood plains', said Jens Peters, Chairman of the German National Committee on Large Dams, opening the 14th Dam Symposium and 7th Meeting of ICOLD's European Club on 17 September in Freising.

The week began with a general meeting of the German National Committee on Large Dams, and a series of presentations followed, as well as a technical exhibition at the conference centre. The Symposium concluded with a technical excursion to the Sylvenstein reservoir, Walchensee hydro plant and the Laboratory of Hydraulic and Water Resources Engineering of the Technical University of Munich at Obernach.

Urban Norstedt, President of the European Club of ICOLD, highlighted in his opening remarks the need to encourage young engineers and students into the field of dam engineering for the future.

Climate, water management and public awareness

The first presentation was given by Wolfgang Lazik, Director General of the Bavarian State Ministry of the Environment, Public Health and Consumer Protection, who discussed flood and climate protection in Bavaria. The Bavarian region, he commented, was sensitive to flooding, and the effects of climate change on water resources were currently being studied in light of this. Although development on flood plains could be stopped, the need to undertake adaptation measures was imperative, to avoid future flooding. He discussed the need for water management, climate protection and the need for greater coordinated planning based on an adaptation strategy to mitigate the

effects of future climate change. Lazik discussed the importance of water storage by dams in the future, especially for cities such as Munich and Augsburg. New reservoir storage in Bavaria would be on a limited scale, and retention options would need to be reassessed. Long-term options, he suggested could include increasing existing reservoir capacity.

Gianni Biasiutti, of KWO Grimselpower, Switzerland, discussed public awareness in relation to the Grimsel hydro project in Switzerland. The Grimsel region of Switzerland was of national importance, he said, and plans to extend the lake had met with intensive opposition. The project involved the flooding of protected land and the loss of woodland areas, and environmentalists had wanted to go to court. Community consultation had followed, and it was clear that stakeholder views would need to be taken into account in future planning. The Grimselwelt brand has been established to keep the public aware of the company's activities and plans.

Andreas Marx of the Federal and State Research Centre in the Helmholtz Community in Germany discussed climate change and the implications for hydraulic engineering and water resources management. Drought, he said, was becoming an issue in Germany, particularly in the Rhine region. A change of mean annual temperatures and lower precipitation had occurred between 1960 and 1989, with warmer summers and periods of dryness increasing. Research was currently being undertaken to assess the impacts of small catchment areas over a ten-year period, he said. A water model of Weilheim in Bavaria showed low-water phases had increased. Marx stressed that regional strategies to safeguard minimum discharges would be an important future issue.

Michael Heiland of Hydroprojekt Ingenieurgesellschaft discussed the Leibis/Lichte dam, making a comparison between concrete block construction and the traditional RCC method. The 102.5 m-high dam was built between 2002-2005 as a gravity dam by Lahmeyer, and is the second highest dam in Germany. Because of its steep slopes and the fact construction teams could not work at night, continuous work was not an option, so the dam was built as a block construction as opposed to RCC. Block assembly had proved to be more adaptable, especially in locations where there is lack of space and environmental protection. Aesthetics were important, Heiland noted.

Theodor Strobl, from the Technical University of Munich, chaired the next few presentations discussing the topic of public awareness in relation to dams in Europe. Bernhard Kalusa of Wasserkraft GmbH discussed the Rosshaupten dam, which had an energy storage reservoir also serving for flood protection,



Jens Peters, Chairman of the German National Committee on Large Dams, giving his opening address.

environmental enhancement, recreation and tourism. The dam, on the Lech river, was constructed between 1950-54. Its reservoir, Forggensee, is the largest artificial lake, its primary purpose being to ensure the storage of the varying inflows and equalize the outflows to improve the production of hydropower at the other plants along the river. After flooding in 1999, flood protection mechanisms had been improved, Kalusa said, including a modification to the systems controlling the overflow spillway of the dam.

Andy Hughes, Vice-President of ICOLD, described the Reservoirs Act of 1975 in relation to the protection of cultural heritage. Approximately 37 per cent of dams in the UK are in public ownership, and 63 per cent in private ownership. Hughes outlined the various responsibilities now faced by the owner/undertaker of reservoirs in the UK today, including working alongside institutions such as the National Trust.

The reconstruction of the Linach dam in Germany was discussed by Robert Strumberger of Vohrenbach. Since 1998, the rehabilitation of the dam had been planned, and was now underway. The dam is being reconstructed with the collaboration of local action groups, sponsors, and the technical and scientific communities.

Helena Nynäs, of the Norwegian Water Resources and Energy Directorate, presented a paper on “dams as storytellers” in Norway. As a contribution to the preservation of dams as historical monuments, the Norwegian Water Resources and Energy Directorate had initiated a project to present a selection of historically important dams in Norway, she said. The “Dams as cultural heritage” programme aimed to ensure the preservation and maintenance of dams of historical importance to the nation.

Disaster management plans for dams were discussed by Jörg Lotz of Wächtersbach, who gave an overview of some of the perspectives in risk management and flood protection plans.

Rodney Bridle of the UK discussed engineering sustainable dams through the Engineered Sustainable Infrastructure Cycle (ESIC), which aimed to optimize the sustainability of infrastructure to meet society's needs by examining the economic and environmental sustainability of alternative infrastructure. Bridle described how dams might be engineered to optimize sustainability.

Benefits and risks of hydraulic structures

Professor Andreas Schumann of Ruhr University chaired the last session of day one, under the topic of “Benefits and Risks of Hydraulic Structures”. Jiri Cemus and Dana Halbe described the management issues of the Eder Reservoir with increasing recreational use of the dam. A strategy to include daily water level checks needed to be introduced, they said.

Andreas Schumann's discussed the various problems and solutions of flood risk reduction with reservoirs. Jens Thorwarth of the Institute of Hydraulic Engineering and Water Resources Management in Germany presented on the self-induced unsteady flow on pooled stepped chutes, used to increase the energy dissipation compared with stepped chutes and cascades with horizontal and flat steps.

Phillipe Lazaro of Lombardi Engineering described the new spillway at the Esch-sur-Sûre dam in Luxembourg, a 50 m-high arch dam built between 1956 and 57. The dam had not been equipped with a surface spillway. The new spillway design consists of two labyrinth weirs discharging into a spillway tunnel passing under the left dam abutment.

An assessment of structural safety of gravity dams was presented by Claudio Carvajal of Safage Consulting Engineering, France, who proposed methodologies for the probabilistic assessment of hydraulic loads and shear strengths.

Maren Niemeyer of Germany presented on a new approach for modelling breach information and flood wave propagation, within the scope of risk assessment of dams.

Leakage detection in embankment dams

The second day of the symposium began with the topic of leakage detection in embankment dams, Chaired by Dr Markus Aufleger of Innsbruck University, Austria.

The first presentation was given by Gregor Overhoff and Stefan Schultheiß of Germany. They described an analysis of geophysical investigations relating to the Sylvenstein dam in Bavaria.

Dr Pontus Sjödhall of Hydro Research AB, Sweden, discussed a method of seepage monitoring at embankment dams, and resistivity measurements carried out at the Sävda embankment dam, aimed at evaluating the seepage. Quantitative assessments of seepage flow had also been carried out as an initial test. The results from this dam, they concluded, were valuable for the application of the resistivity method on embankment dams, and could be used for qualitatively assessing the seepage situation of the dam.

Dr Sam Johansson of Hydro Research AB, Sweden, discussed seepage measurements and internal erosion detection using passive temperature, which had been applied on about 40 Swedish dams since 1987. This was now a well established methodology in Sweden he said, and optical fibres used for distributed temperature sensing had been introduced in Sweden in 1998. The technology he discussed had allowed for improved seepage information to be obtained along the entire dam.

Distributed flow velocity measurement in embankment dams was described by Dr Sebastian Perlzmaier of TIWAG Austria, followed by Cyril Guidoux from Laboratoire des Transferts en Hydrologie et Environment (LTHE) who discussed active and passive temperature measurement using optical fibre detection methods to locate leaks in dams.

Hydraulic structures and hydropower

The session on ‘Hydraulic Structures and Hydropower - ongoing projects at home and abroad’ was chaired by Professor Jürgen Köngeter of Aachen University.

Dr Martin Wieland of Pöyry gave the first presentation on the 249 m-high Deriner arch dam in Turkey. The double-curvature dam, to be completed in 2010, had been designed to withstand extreme impacts of seismic activity and flooding. In the safety evaluation, a peak ground acceleration of 0.35 g and maximum flood of 10 110 m³/s had to be considered.

This was followed by Dr Robert Boes of TIWAG Austria who discussed the design of a 120 m-high rockfill dam in the Tyrol region of Austria. TIWAG is planning to extend the Sellrain-Silz pumped-storage scheme by adding another rockfill dam and reservoir and an underground aqueduct to collect water from a 60 km² catchment area.

Dams in the Karstic mountains of Jordan was the topic of the next presentation by Theodor Strobl, in his presentation Strobl focused on two RCC dams in Jordan with difficult geological conditions: the 80 m-high Al-Wehda is currently under construction; and,

the sealing problems that occurred after the impounding of the 60 m-high Mujib dam, a combination of RCC and earthfill.

Marco Conrad outlined the advantages of RCC dams in the Southeast Asian region. Two examples of successful RCC dam projects he drew attention to were the Son La in Vietnam and Yeywa in Myanmar. With time pressures, hydrological and meteorological issues to contend with in this region, the RCC method had been advantageous in construction sequence planning, including the intentional overtopping of RCC during the rainy season to contributing to cost savings for river diversion and time and cost savings for the project as a whole.

The next presentation, by Michael Humbsch, focused on the refurbishment of the Klingenberg dam. After the drawdown of the reservoir has been completed in 2008, the refurbishment will be undertaken. An alternative water system was needed, he said, to supply 350 000 people during the refurbishment process. The works had required a gallery to be constructed in 2006 which would be used to transport raw water from the newly built upper pre-dam around the empty reservoir.

A structural safety assessment of four Algerian dams was presented by Frank Rösler of Ruhrverband. In 2003, The Algerian Dam Authority Refurbishment Plan had called for the inspection and structural safety assessment of several dams in Algeria. The Bou Hanifa, Djorf Torba, Beni-Bahdel and Meffrouch dams had been examined for potential earthquake loading scenarios and hydrological and geological assessments.

Innovative solutions for hydraulic concrete structures damaged by alkali aggregate reaction (AAR) were proposed by Christian Kubens. Damage to concrete structures caused by AAR had become a global problem, he said. One prevention method suggested was to use a low alkali cement.

The second part of the Hydraulic Structures and Hydropower topic was chaired by Gerald Zenz of the Technical University of Graz, Austria.

Reinhard Frohnauer, of Strabag, described the asphalt lining of a large water reservoir near Benghazi in the Sahara desert.

This was followed by a presentation on the rehabilitation of the bituminous lining system of the Eggberg reservoir, presented by Gundo Klebsattel. The sealing system of this reservoir consisted of a double layer of dense asphalt concrete. After 40 years of operation it could no longer withstand the various stresses and loads, and a new dense layer had been installed covered by an additional sealing of sand mastic. The works had been completed in 2005, Klebsattel said.

The construction of the first cut-off wall by a low headroom trench cutter inside a dam tunnel in China was the topic covered by Wolfgang Brunner of Bauer. The 240 MW Yeleh hydro plant in China had includ-

ed the construction of a concrete-off wall inside the dam tunnel by means of a low headroom cutter. The construction is a very recent case study for Bauer.

Injection grouting at hydro plants and dams in Russia and the CIS countries was the topic presented by Archibald Richter of Minova CarboTech. The most difficult project, he said, had been Ust-Ilimsk in Siberia, where the expansion joints had not been watertight, resulting in large volumes of water flowing out from the structure. The sealing material that had been washed out of the expansion joints had been replaced by injected products, using special techniques for this project.

Richter also drew attention to the fact Russia had harnessed less than 25 per cent of its vast hydro potential to date, and that the country's future growth would be helped by the export of hydropower.

New projects of E.ON Hydropower were introduced by Karl-Heinz Straßer, who outlined the construction of six run-of-river projects the company is currently developing. The changing conditions in the construction industry and turbine manufacturing had created greater difficulties for project scheduling and profitability. Greater active support was required from authorities for current and future projects, he suggested.

The Lower Kokcha irrigation and hydro project in Afghanistan was described by Patrick Schäfer of Fichtner GmbH. The project, located in northern Afghanistan, is situated on the Kokcha river, near the Tadjik border. It covers 150 000 ha of land, enhancing and expanding existing irrigation facilities. The project was initially designed in the 1960s and 1970s by the Central Asian State Designing Prospecting and Research Institute for Irrigation and Melioration Construction. Although the planning stage had been prepared, work had been discontinued after war had disrupted plans.

Many local people in the area had suffered a lack of drinking water.

The World Bank-funded project aims to upgrade initial design work and data to current standards with the aim of achieving increased electrification in the region.

The final presentation was delivered by Roland Schmidt of Lahmeyer International, who outlined the results of a feasibility study conducted on the construction completion for the Rogun hydro project in Tadjikistan. The project, located 100 km east of the capital Dushanbe is situated on the Vakhsh river at the head of a cascade of five existing plants. One of the plants, the 300 m-high Nurek dam, is currently the world's highest dam. The site is geologically and tectonically difficult; seismic activity exists in the vicinity of Rogun. The original design for Rogun began in 1978. Construction of the plant began in 1982, but stopped in 1983 after floods destroyed the cofferdams. The seismic activity and energy dissipation from water discharged into the tailwater are challenging conditions. The works will also entail the rehabilitation of tunnels, dam height optimization and a draft design concept, which could include an alternative design for an arch dam.

The closing ceremony was officiated by ICOLD European Club President, Urban Norstedt, who acknowledged the German Dams Committee as a technically and socially efficient and effective committee. He thanked the speakers, chairmen and participants. Concluding the event, German Dams Committee President, Jens Peters also thanked Luis Berga for his attendance of the event, looked forward to a positive future within new framework conditions and added his thanks to the speakers, chairmen, delegates and exhibitors for a lively symposium and social programme. ◇



Chairman Gerald Zenz, addressing delegates during the second session of the symposium.